

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

Rec'd PCT/AT 07 SEP 2004

PCT

22 SEP 2004

To:

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NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing

(day/month/year)

20.04.2004

Applicant's or agent's file reference

XA1555

## IMPORTANT NOTIFICATION

International application No.

PCT/GB 03/00934

International filing date (day/month/year)

04.03.2003

Priority date (day/month/year)

08.03.2002

Applicant

BAE SYSTEMS PLC ET AL.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.
4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the international  
preliminary examining authority:

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# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT (PCT Article 36 and Rule 70)

Applicant's or agent's file reference <b>XA1555</b>	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. <b>PCT/GB 03/00934</b>	International filing date ( <i>day/month/year</i> ) <b>04.03.2003</b>	Priority date ( <i>day/month/year</i> ) <b>08.03.2002</b>
International Patent Classification (IPC) or both national classification and IPC <b>G01J5/52</b>		
Applicant <b>BAE SYSTEMS PLC ET AL.</b>		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 4 sheets.</p>		
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li>I <input checked="" type="checkbox"/> Basis of the opinion</li> <li>II <input type="checkbox"/> Priority</li> <li>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li>IV <input type="checkbox"/> Lack of unity of invention</li> <li>V <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li>VI <input type="checkbox"/> Certain documents cited</li> <li>VII <input type="checkbox"/> Certain defects in the international application</li> <li>VIII <input type="checkbox"/> Certain observations on the international application</li> </ul>		
Date of submission of the demand  <b>11.09.2003</b>	Date of completion of this report  <b>20.04.2004</b>	
Name and mailing address of the international preliminary examining authority:  <div style="display: flex; align-items: center;"> <div>             European Patent Office              D-80298 Munich              Tel. +49 89 2399 - 0 Tx: 523656 epmu d              Fax: +49 89 2399 - 4465           </div> </div>	Authorized Officer  <b>Denise, C</b>  Telephone No. +49 89 2399-2452	



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB 03/00934

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, Pages**

1, 3-7 as originally filed  
2, 2a filed with telefax on 18.03.2004

**Claims, Numbers**

1-13 filed with telefax on 18.03.2004

**Drawings, Sheets**

1/4-4/4 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB 03/00934

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims	1-13
	No: Claims	
Inventive step (IS)	Yes: Claims	1-13
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-13
	No: Claims	

2. Citations and explanations

**see separate sheet**

## **SECTION V**

- 1** Reference is made to the following documents;

D1 = GB-A-2 184 861 (SEC DEP FOR TRADE & INDUSTRY T) 1 July 1987  
(1987-07-01)

D2 = US-A-4 387 301 (WRIGHT JAMES P ET AL) 7 June 1983 (1983-06-07)

D3 = US-A-5 572 312 (KARLSSON LARS ET AL) 5 November 1996 (1996-11-05)

D4 = EP-A-0 316 103 (BRITISH AEROSPACE) 17 May 1989 (1989-05-17)

D5 = WO-A-9923516

D6 = US-A-5298752

Documents D5 and D6 have been introduced by the examiner during the procedure. A copy of both documents is annexed to the file.

- 2** Novelty (Article 33 (2) PCT) and inventive step (Article 33 (3) PCT)

**2.1** Claim 1

Independent claim 1 concerns an infrared (IR) detector calibration system comprising a reference surface on which are disposed a plurality of hollow corner cubes which are partially reflective and partially emissive.

**2.2** Prior art

The closest prior art is represented by document D2 which discloses a system for calibrating an IR detection device, wherein a target of dielectric material is located on a substrate in order to provide small temperature differences between the target and the substrate. A temperature resolution of an IR detector can be calibrated with the disclosed device.

Document D2 does not disclose nor hint at the use of reference surfaces comprising a plurality of hollow cube corners. Moreover, the reference surface used in D2 does not need to reflect the incoming IR radiation but to absorb it, whereas in claim 1, the reference surface is partially reflective.

Thus, the subject matter of claim 1 is novel over D2.

Document D1 discloses a device for IR calibration equipment made of a metallic surface filled up with absorbent material.

Document D1 does not disclose nor hint at the use of reference surfaces comprising a plurality of hollow cube corners. In D1, the projection elements (4) do not form cube corner elements because the incoming IR radiation is not reflected by the surface (see column 2, lines 70-72) but absorbed by the material disposed on said metallic surface.

Thus, the subject matter of claim 1 is novel over D1.

Document D3 discloses an arrangement for calibration of an IR detector. Document D3 does not disclose nor hint at the use of reference surfaces comprising a plurality of hollow cube corners.

Thus, the subject matter of claim 1 is novel over D3.

Document D4 discloses an apparatus for calibrating an IR detector, comprising a image generator having differing reflectance coefficients across its surface.

Document D4 does not disclose nor hint at the use of reference surfaces comprising a plurality of hollow cube corners.

Thus, the subject matter of claim 1 is novel over D4.

Documents D5 and D6 disclose a specific cube corner article (D5) and a calibrating device comprising cube corners in order to increase the cold shield efficiency (D6).

None of documents D1-D6 discloses the use of a surface comprising a plurality of hollow cube corner elements.

Thus, the subject matter of claim 1 is novel and involves an inventive step over the prior art.

### **2.3 Claims 2-7**

Claims 2-7 are dependent on claim 1. Their subject matter is therefore novel and involves an inventive step.

**3** Claim 8

- 3.1** Claim 8 corresponds to originally filed claim 7 apart from the fact that the original characteristic wherein the reference surface used was a surface comprising a plurality of hollow corner cubes is missing. In claim 8, the reference surface (52) can be, according to the drafting of claim 8, any type of surface.

Because the use of a reference surface comprising a plurality of hollow corner cubes is indicated in the description of the present application as an essential characteristic of the device defined in claim 1 and of the method defined in claim 8, it comes that the amendment made to claim 8 goes beyond the disclosure in the international application as filed (Article 19 (2) PCT).

Claims 9-13 are dependent on claim 8. The objection concerning Article 19 (2) PCT is also valid for those claims.

- 3.2** In case the reference surface (52) used in claim 8 was meant to be the surface defined in claim 1 (which, in the present drafting of claim 8 is not the case), it would follow that the subject matter of claim 8, as well as dependent claims 9-13, would satisfy the requirements of Article 33 (2) PCT and Article 33 (3) PCT for reasons to those discussed at point 2 of the present International Preliminary Examining Report.

It is known to calibrate IR cameras by taking readings from each element when one or more reference surfaces at different temperatures are presented to the camera. These readings are then used to calibrate the camera. For robust and accurate calibration, it is necessary to present surfaces generating flux levels covering the range of those which may be encountered in the scenes to be imaged. However, the provision of a sufficiently cold reference surface to generate the low flux levels equivalent to scenes often encountered in practice requires substantive cooling of the reference surface. This can be expensive and difficult to achieve.

10 It is therefore an object of the present invention to provide a calibration system which overcomes the need to cool the reference surface.

In accordance with one aspect of the present invention, there is provided an infra red detector calibration system comprising a reference surface which comprises a plurality of hollow corner cubes which are partially reflective and partially emissive, temperature controlling means adapted to maintain the reference surface at a desired calibration temperature, processing means for receiving an output signal generated by an infrared detector at said the desired calibration temperature, comparing said detector output signal with a predetermined ideal output signal for said desired calibration temperature and calculating a calibration coefficient on the basis of the difference between the detector output signal and the ideal output signal at said desired calibration temperature.

25 In accordance with another aspect of the present invention, there is provided a method of calibrating an infra red detector comprising a plurality of detector elements, the method comprising:-

presenting a reference surface at a known temperature to an infra red detector;

measuring the output of each detector element;

30 comparing the measured output of each detector element with a nominal output for the known reference surface temperature to determine a calibration error at the known temperature; and



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heating the reference surface to one or more further known temperatures and repeating steps b) and c) to determine a calibration errors for each of the further known temperatures.

For a better understanding of the present invention, reference will now be  
5 made, by way of example only, to the accompanying drawings in which:-

Empfangszeit 18.März 12:33

AMENDED SHEET

**CLAIMS:**

1. An infra red detector calibration system (50) comprising a reference surface 52 which comprises a plurality of hollow corner cubes which are partially reflective and partially emissive, temperature controlling means (54, 58) adapted to maintain the reference surface (52) at a desired calibration temperature, processing means (62, 64) for receiving an output signal generated by an infrared detector (56) at said the desired calibration temperature, comparing said detector output signal with a predetermined ideal output signal for said desired calibration temperature and calculating a calibration coefficient on the basis of the difference between the detector output signal and the ideal output signal at said desired calibration temperature.
2. An infra red detector calibration system according to claim 1 wherein the emissivity of the reference surface is controlled by controlling the temperature of said reference surface.
3. An infra red detector calibration system, according to claims 1 or 2, wherein each corner cube comprises a reflective surface and a matt surface to form an effective surface emissivity of N%.
4. An infra red detector calibration system according to claim 3, wherein the reflective surface comprises a silvered surface.
5. An infra red detector calibration system according to claim 3, wherein the reflective surface comprises an aluminised surface.
6. An infra red detector calibration system according to any one of claims 3 to 5, wherein the matt surface comprises a matt black paint overlying the reflective surface.
7. An infra red detector calibration system according to any one of claims 3 to 5, wherein the matt surface comprises a non-reflective surface etched into the reflective surface.
8. A method of calibrating an infra red detector comprising a plurality of detector elements using a reference surface (52), the method comprising:-

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- a) presenting the reference surface (52) at a known temperature to an infra red detector;
- b) measuring the output of each detector element;
- c) comparing the measured output of each detector element with a nominal output for the known reference surface temperature to determine a calibration error at the known temperature; and
- d) heating the reference surface to one or more further known temperatures and repeating steps b) and c) to determine a calibration errors for each of the further known temperatures.
9. A method according to claim 8, further comprising the step of calculating a function relating the output error of each detector element to the temperature of the reference surface (52).
10. A method according to claim 9, wherein the function is a polynomial function.
11. A method according to any one of claims 8 to 10, further comprising the step of storing the calibration constants for application to readings obtained from the detector.
12. An infra red detector calibration arrangement substantially as hereinbefore described with reference to the accompanying drawings.
13. A method of calibrating an infra red detector substantially as hereinbefore described with reference to Figure 4 of the accompanying drawings.